# Bruker alicona


Optical coordinate measuring system µCMM

with new operator software MetMeX:

From “How do I measure?” to “What do I measure?”

# MetMaX

## µCMM Software

Optical production measurement

# New coordinate measuring machine sets a benchmark


## µCMM

µCMM combines the advantages of tactile coordinate measuring technology and non-contact surface measuring technology:

- Measurement of dimension, position, shape and roughness in one system
- high accuracy over the entire measurement volume
- non-contact, optical measurement with Focus-Variation
- suitable for matte to highly polished components
- easy handling
- wear-free, robust, suitable for production

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# The new µCMM

## Measure components with extremely tight tolerances in high accuracy

µCMM is the most accurate purely optical micro-coordinate measuring machine in its class. Based on Focus-Variation, it offers all the advantages of this optical technique. These include high-resolution measurement of components with steep flanks and high reflections, insensitivity to vibrations and a high number of measuring points. Users can measure dimensions, position, shape and roughness of their components fully automatically.

## What µCMM offers

### » high geometrical accuracy of multiple optical 3D measurements to each other.

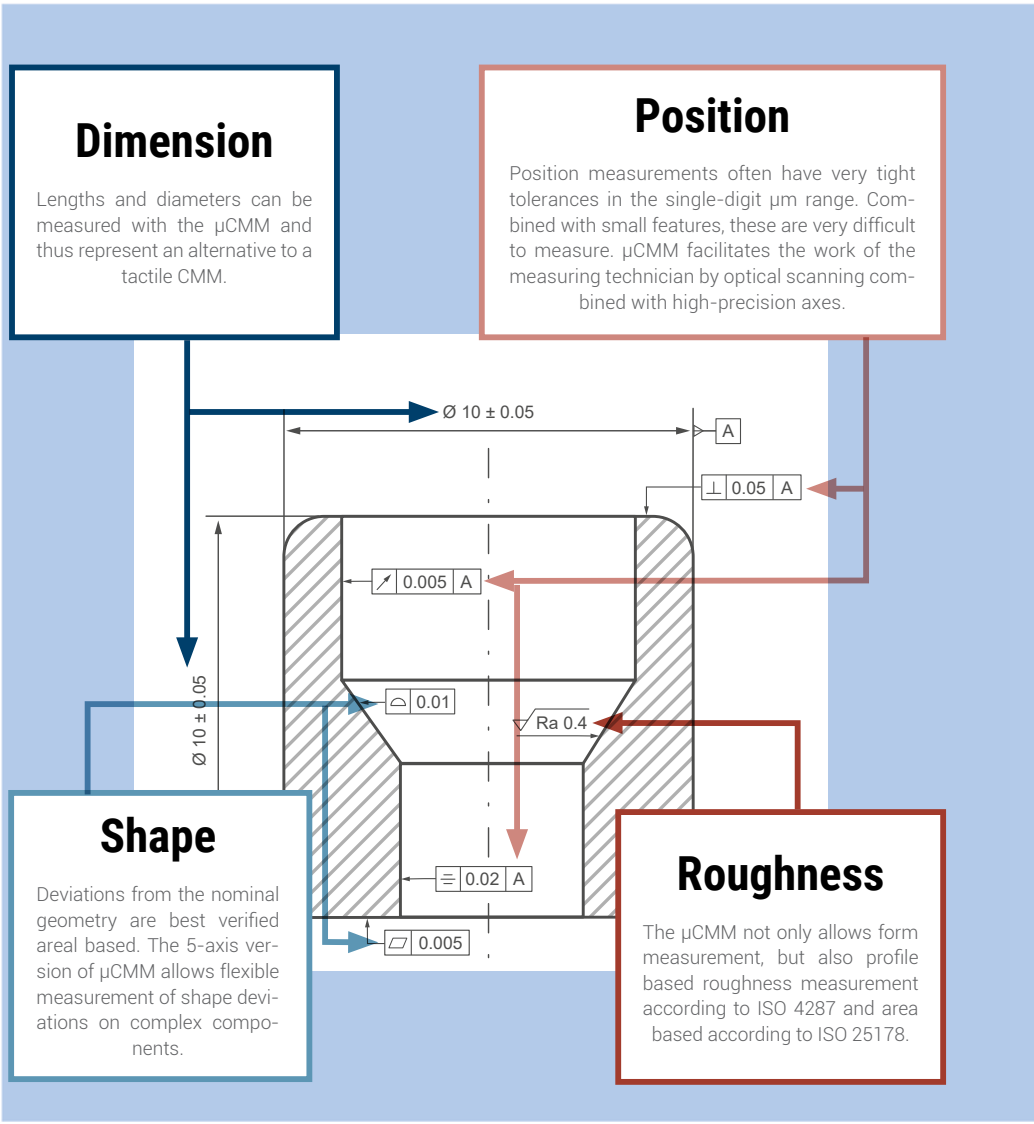
The length measurement error in the total measuring volume of 310 x 310 x 310 mm is below E= (0.8+L/600) µm and according to ISO 10360/VDI 2617. Users measure very small geometries, free-form surfaces and so on over large distances in high density and accuracy. This enables the measurement of small surface details on small and large components and precisely determining their position in relation to each other.

### » dense non-contact and material-independent measurement with one sensor.

The spectrum of measurable surfaces is largely material-independent and includes all materials and composites commonly used in the industry, from matte to polished or mirrored components. Components made of plastic, PCD, CFRP, ceramic, chrome, silicon etc. are measured with one sensor only.

### » intuitive usability, designed for multiple users.

µCMM is a one-sensor solution that is easy to learn. Single-button solutions, automated measurement sequences and long-term stability ensure consistent measurement results. Details such as a specifically developed, ergonomic controller support easy operation.




### » wear-free and efficient use.

All components, including the moving axes, operate contact-free. Air-bearing linear drive axes enable wear-free operation and high-precision, fast measurement. This makes µCMM ideal for permanent use in production. Measurements without sample preparation or complex clamping increase user-friendliness and ensure efficient use.

# Precise, simple, expandable

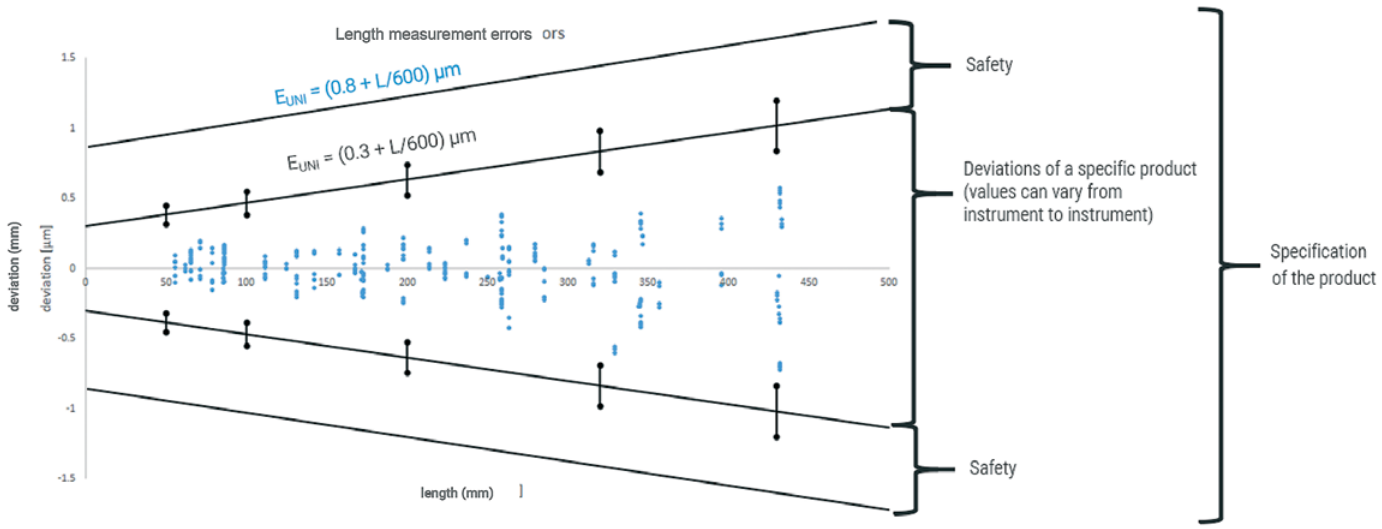
## What makes µCMM so precise, easy to use and flexible?

The optical µCMM offers high accuracy for the fast measurement of components with tight tolerances. It reproducibly measures matte to highly polished surfaces and is designed to be easily used by multiple operators. Simple automation options and optional accessories extend application areas. Interfaces for networking with existing production systems ensure the implementation of future-oriented, integrated production strategies.

# PRECISE

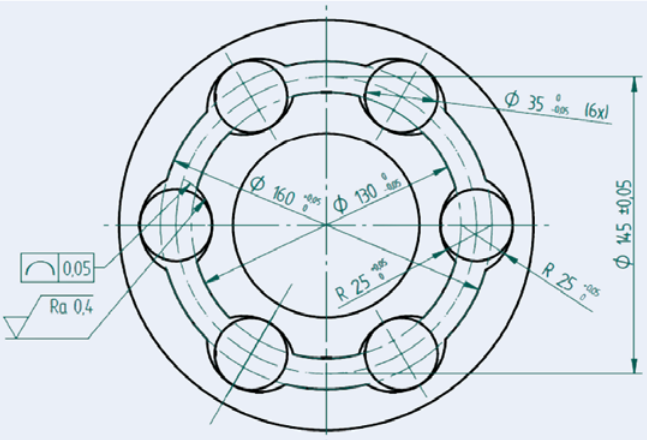
### High accuracy and fast measurement over large measurement volumes

µCMM enables highly accurate measurements of the smallest geometric features, even on large components. The individual surface characteristics are verified with large measuring point density. Due to the high accuracy of the axis systems, these individual measurements can be precisely set in relation to each other within the entire measurement volume. A 3D measurement is only done at the relevant measuring positions and thus in a very short time. Users now have the ability to measure both surface roughness and GD&T features with tolerances in the single-digit µm range with only one measurement system.

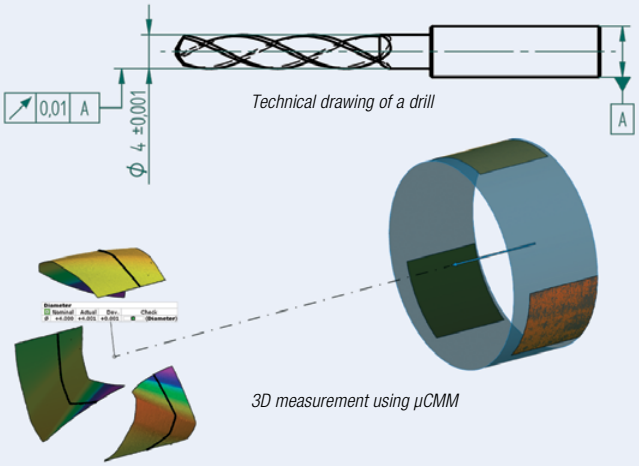



» Each point represents a distance measurement of a specific length
» 5 lengths, 3 times, 7 directions, according to ISO 10360-8
» Test uncertainty according to ISO 23165: U(k=2) = 0.05 µm + 0.3 µm/m (laser interferometer)

Part of the µCMM calibration is the determination of the length measurement errors according to ISO 10360:8. In this example µCMM achieves a length measurement error of 0.3+L/600 over the entire travel distance. The difference of 0.5 µm to the accuracy specification of 0.8+L/600µm shows that the accuracy specification of the micro coordinate measuring system is chosen conservatively.




Shape deviations of hemispherical shells, as shown here with a CV joint, are measured in high vertical and lateral resolution. Ball shells, which are used in many industries, often have complex material properties due to the combination of matte and highly polished surfaces. The SmartFlash technology integrated in the µCMM enables fast, simple and high-precision measurement.



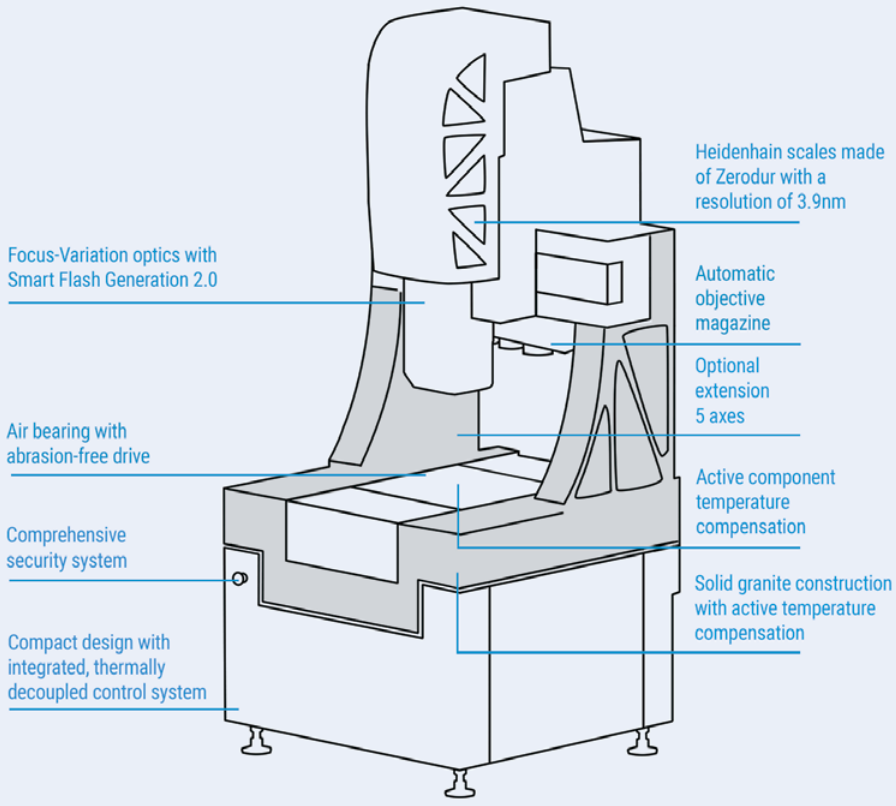

*Technical drawing of a drill*

*3D measurement using µCMM*

µCMM offers high accuracy of several optical 3D measurements to each other. A 3D measurement is only done at the relevant measuring positions and thus in a very short time. Due to the high accuracy of the axis systems, these individual measurements can be precisely set in relation to each other within the entire measurement volume.

## Measure matte and highly polished surfaces easily with SmartFlash

The measurement of complex component geometries is easy for an operator to carry out. µCMM adapts to the surface with one single sensor and measures all common industrial surfaces, all with dramatically different reflection properties.




## SmartFlash 2.0

The measurement of matte to highly polished components is done with SmartFlash technology developed by Alicona in 2004. The core of SmartFlash is the use of modulated illumination during the vertical scanning process. Each measurement point is optimally illuminated, resulting in a robust and high 3D depth resolution. The further development of SmartFlash 2.0 is based on intensity modulation as a function of time and simultaneously as a function of the lateral position. While a single measurement point is illuminated with varying intensity at different points in time, two measurement points are illuminated with varying illumination at the same time. As a result, users not only gain a robust and high depth resolution, but also a significantly more robust and higher lateral resolution. Rough, smooth, and reflective surfaces are optimally illuminated and measured in 3D.

# Simple

## From “How do I measure?” to “What do I measure?”

This is the core thinking behind MetMaX, the µCMM operating software. Thanks to this evolution, users do not need any specific metrology knowledge to perform robust measurements with the µCMM coordinate measuring machine. MetMaX contains all the necessary knowledge on how to acquire and evaluate 3D data.

When the CAD data set for a component is uploaded, operators can use a simple mouse click to select which GD&T or PMI (Product Manufacturing Information) parameters to measure. MetMaX automatically configures the ideal measurement strategy for an optimized 3D measurement of the part. MetMax software autonomously calculates probing directions, tilt, rotation angles and travel directions in XYZ. Before measurement starts, a virtual simulation ensures a collision-free measurement sequence. The measurement is started by the operator with a click of the mouse and is fully automated. Once the 3D measurement is finished, data is automatically analyzed. If, for example, form deviations are to be verified, the µCMM equipped with MetMaX software chooses which geometric form (cylinder, plane, sphere, etc.) must be fitted.

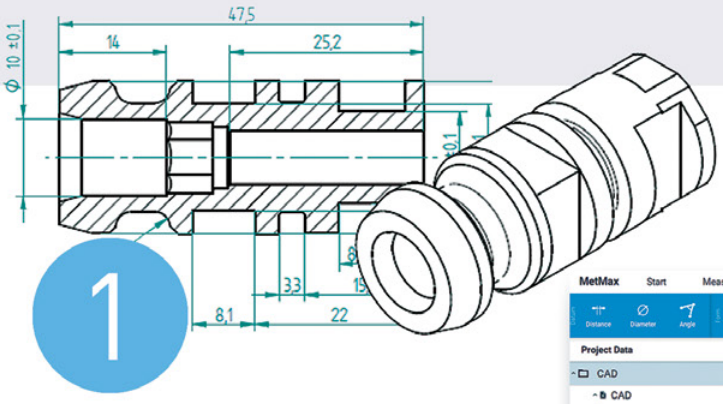
The MetMaX reporting system gives an ok/not ok report which complies with the latest industry standards and can be configured according to user specifications.

## MetMaX algorithms possess optical metrology expert knowledge

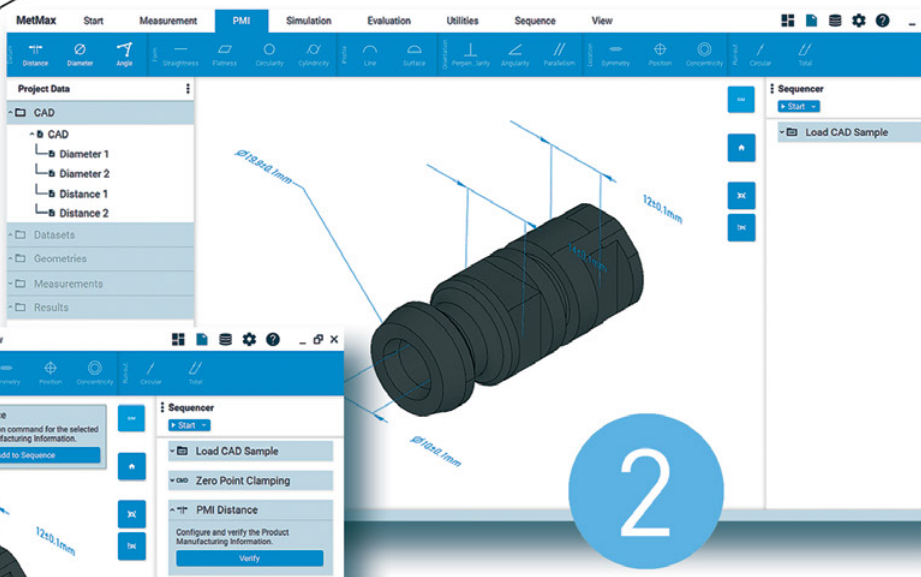
MetMaX takes the µCMM to a new level of metrological performance. Algorithms behind MetMaX are the result of our 15+ years of experience, knowledge and technological expertise in the field of optical measurement. Today, this knowledge offers the possibility to use a high-precision optical measuring system to improve production. Users no longer need to overthink their measurement strategy. MetMaX algorithms take care of this process for them. The µCMM optical coordinate measuring system is not “only” a metrology device to measure complex geometries with high precision based on a robust areal measurement principle; it also is a planning and reporting measurement system. In combination with MetMaX operating software, we implemented our holistic definition of a production-ready coordinate measuring system. It goes beyond the basic requirements of measuring process capabilities to define production suitability where the operator is included.

In our opinion, measuring systems must not only be able to measure components with the necessary accuracy, but also record and evaluate data at any time and independently of the knowledge or experience of the operator.

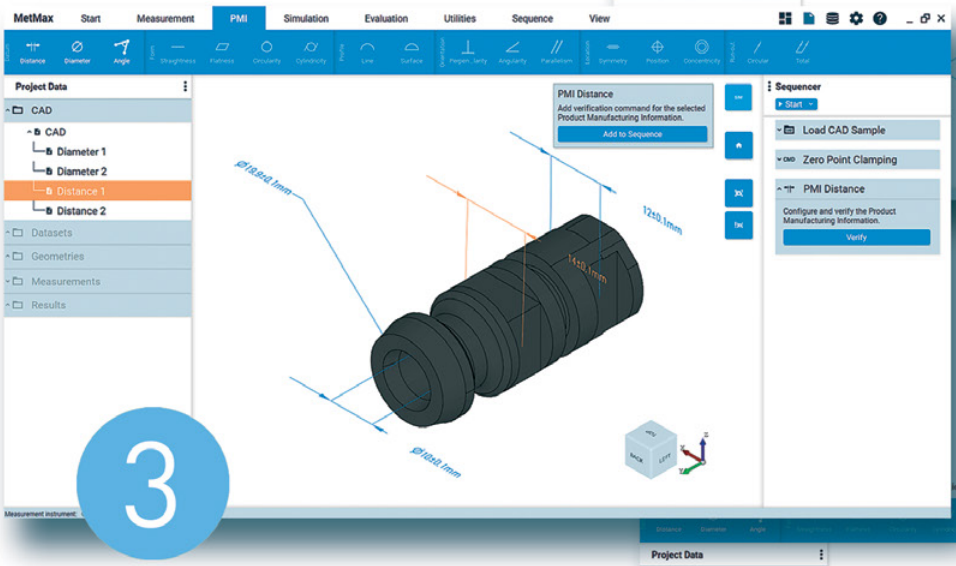
This combination enables monitoring processes at any stage during production or at different locations while - at the same time - giving the necessary flexibility to react swiftly and efficiently when components are not within the required specifications.



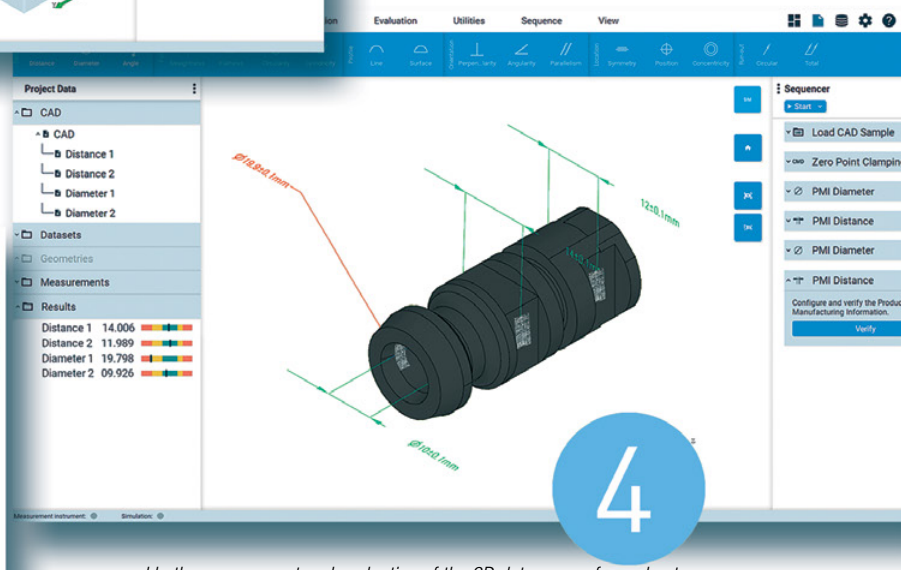

*Dimensioned technical drawing of a component that must be verified.*




*The CAD data set of the part to be measured is uploaded into MetMaX...*



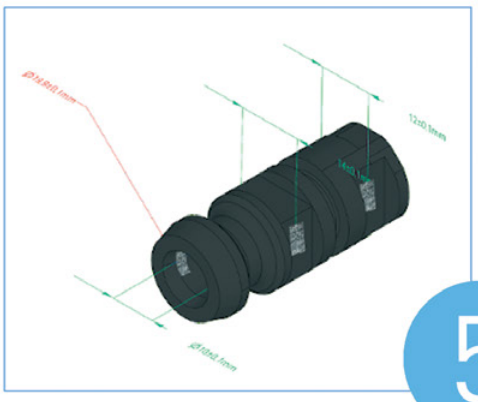

*... the user selects the appropriate GD&T or PMI feature...*




*... and both measurement and evaluation of the 3D data are performed automatically. MetMaX indicates when specifications are out of tolerance.*

## Measurement Report

| Job | PO1234 | Article | 789 |
|---|---|---|---|
| Date | 14.02.2020 | Operator | John Doe |
| Description | Part 789, Distance and Diameter Verification | | |



| Feature | Reference | Value | Tolerance | Ok |
|---|---|---|---|---|
| Distance 1 | 14.0 mm | 14.006 mm | 0.1 mm | |
| Distance 2 | 12.0 mm | 11.989 mm | 0.1 mm | |
| Diameter 1 | 19.0 mm | 19.798 mm | 0.1 mm | |
| Diameter 2 | 10.0 mm | 9.926 mm | 0.1 mm | |

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*The reports can be easily configured according to user-specific criteria.*

# Expandable

## Maximum adaptation to business processes

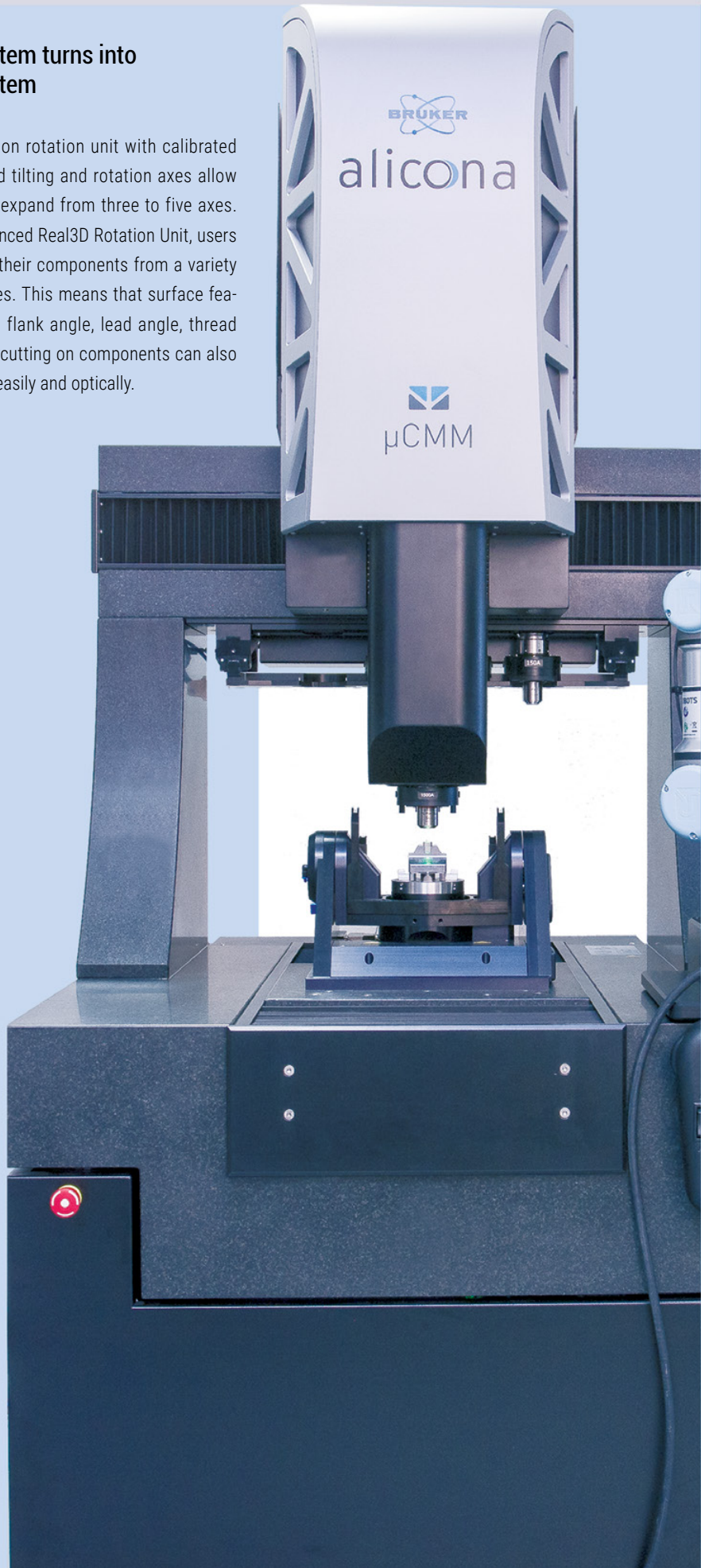
The "Automation Manager" automation interface is an additional option for adapting measurement and testing processes in production to user-specific applications and individual company processes. Customers receive a GUI interface tailored to their measurement task. The Automation Manager is based on the interaction of an administrator who configures measurement programs and one or more operators who start any measurement program at the push of a button. The programs are selected via drop-down menu or barcode scanner, and the 3D measurement and evaluation run automatically.

## Networking and machine to machine communication

Modern production facilities are increasingly moving towards SmartManufacturing, where measurement technology is already an integral part of production that is linked to existing production systems. µCMM has all the prerequisites to be integrated into a production line. The robust technology of the Focus-Variation as well as the stable construction make the optical CMM suitable for production. Interfaces such as .net remoting and various connectivity options (i.e. QDAS) or a CAD CAM connection ensure networking and communication with existing production systems, machines and quality management systems.

## 3-axis system turns into 5-axis system

A high-precision rotation unit with calibrated and motorized tilting and rotation axes allow the µCMM to expand from three to five axes. With the Advanced Real3D Rotation Unit, users can measure their components from a variety of perspectives. This means that surface features such as flank angle, lead angle, thread pitch or undercutting on components can also be measured easily and optically.



## Pick & Place: Automatic placement, measurement and sorting

µCMM can be extended to a complete "Pick & Place" solution with a collaborative robotic arm. In this configuration, automatic placement, measuring and sorting of parts can be realized in one measuring process. An administrator defines corresponding measuring programs (teach in) and the robot takes over the assembly of the measuring system with the components to be tested. After the 3D measurement and evaluation, the parts can be automatically sorted into O.K. / not O.K parts.


# µCMM in use

## Measurement of 3-up stamping inserts "This reduces measurement times by more than 2/3!"

Stepper, one of the German technology leaders in high performance stamping technology uses the µCMM measuring system for automated measurement of 3-up stamping inserts. The insert is a component part of stamping tools, which are used for i.e. the production of automotive contact parts. Stepper produces up to 2550 contacts per minute, so within a few years 3 billion parts have been produced. Marcel Heisler, head of laser ablation and high-speed cutting knows the most crucial features of these tools:

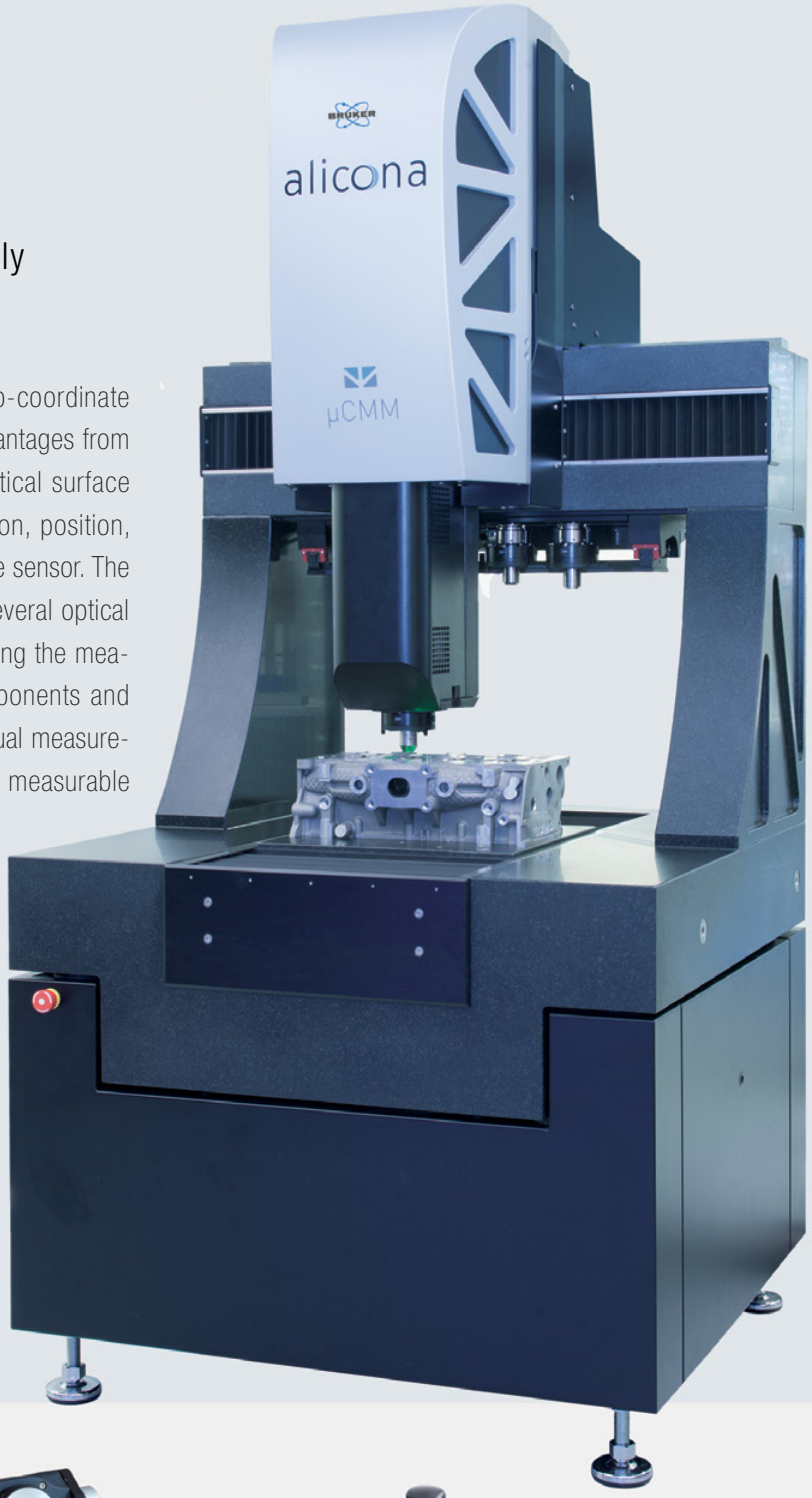
"For inserts, the most important factors are dimensional accuracy, surface quality and the position of the tool in relation to the outer contour. With the CMM I cover all this with just one optical sensor."

For tool supplier Stepper the µCMM coordinate measuring system is the ideal solution. On the one hand, the system delivers high accuracy with tolerances in the single-digit µm range. On the other hand, the tool manufacturer benefits from the efficient user guidance as µCMM is designed for the use by several operators. Stepper has already recorded a reduction in measuring times. The decisive factor is that not the entire component has to be scanned in order to verify the relevant component geometries. "We only measure those parts of the outer contour that we really need," confirms Heisler. "This reduces measuring times by more than 2/3."

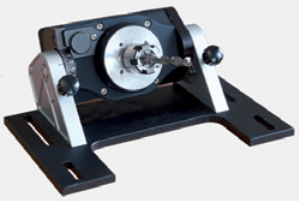
# µCMM

## Measure components with extremely tight tolerances in high accuracy

µCMM is the most accurate purely optical micro-coordinate measuring system in its class. Users combine advantages from tactile coordinate measuring technology and optical surface measuring technology and measure the dimension, position, shape and roughness of components with only one sensor. The optical CMM offers high geometric accuracy of several optical 3D measurements in relation to each other, enabling the measurement of small surface details on large components and precisely determining the position of these individual measurements in relation to each other. The spectrum of measurable surfaces includes all common industrial materials and composites such as plastics, PCD, CFRP, ceramics, chrome, silicon. Materials from matte to polished, reflective components can be measured. Simple operation is implemented by single-button solutions, automation and ergonomic control elements such as a specially designed controller. Air-bearing axes with linear drive enable wear-free use and highly accurate, fast measurements. This makes µCMM ideal for permanent use in production, too.




AdvancedReal3D RotationUnit G2

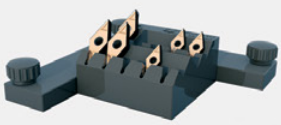


Real3D Rotation Unit G2

RotationGrip

RinglightHP

AdvancedInsertGrip



InsertGrip G2

ToolGrip

## GENERAL SPECIFICATIONS

| | |
|---|---|
| **Measurement principle** | non-contact, optical, three-dimensional, based on Focus-Variation incl. Vertical Focus Probing technology |
| **Number of measurement points** | single measurement: X: 1720, Y: 1720, X x Y: 2.95 million<br>multi measurement: up to 500 million |
| **Positioning volume (X x Y x Z)** | 310 mm x 310 mm x 310 mm = 29 791 000 mm³ |
| **Compressed air** | maintainance-free with compressed air according to specification, 7 bar<br>consumption 80 Nl/min. |
| **Travel speed of axes** | up to 100 mm/s |
| **Coaxial illumination** | LED coaxial illumination (color), high-power, electronically controllable |
| **3D data** | monochrome; 3D color data from Q2 2021 |
| **Objective changer** | automatic pneumatic four-place objective changer |
| **System monitoring** | 9 temperature sensors (accuracy ± 0.1 K), 3 vibration sensors, internal current and voltage monitoring, incl.<br>long-term logging, retrievable |
| **ControlServerHP** | 4 Core, 32 GB DDR4, HDD 2 TB, Windows 10 IoT Enterprise 64bit, 2x 27" Full HD LED Monitor |

## DIMENSIONS

| | |
|---|---|
| **Dimensions (W x D x H)** | measurement instrument: 960 x 1109 x 1958 mm (up to 2288 mm); ControlServerHP: 200 x 490 x 440 mm |
| **Mass** | measurement instrument: 1250 kg (incl. steel stand); ControlServerHP: <20 kg |

## MEASUREMENT OBJECT

| | |
|---|---|
| **Max. weight** | 30 kg; more on request |
| **Max. dimensions** | width: 680 mm, height: 375 mm |
| **Max. measurable slope angle** | Focus-Variation: 87° / Vertical Focus Probing: >90° |

## ACCURACY

| | | |
|---|---|---|
| **3D accuracy ISO 10360-8 (*)** | $E_{Uni:Tr:ODS,MPE}$ = (0.8 + L/600) µm (L in mm) (**)<br>$E_{UniZ:St:ODS,MPE}$ = (0.15 + L/50) µm (L in mm) (***) | |
| **Flatness deviation** | 1.3 mm x 1.3 mm with 10x objective (800A) | U = 0.1 µm |
| **Profile roughness** | Ra = 0.1 µm<br>Ra = 0.5 µm | U = 0.012 µm, σ = 0.001 µm<br>U = 0.02 µm, σ = 0.001 µm |
| **Areal roughness** | Sa = 0.1 µm<br>Sa = 0.5 µm | U = 0.01 µm, σ = 0.001 µm<br>U = 0.015 µm, σ = 0.001 µm |
| **Wedge angle** | β = 70° - 110° | U = 0.075° , σ = 0.01° |
| **Edge radius** | R = 5 µm - 20 µm<br>R > 20 µm | U = 1.5 µm, σ = 0.15 µm<br>U = 2 µm, σ = 0.3 µm |

(*) Values based on ISO 10360-8 and VDI 2617. Valid for measuring room of quality class 2 according to VDI 2627, further accuracy values available for other environments.
(**) Axis accuracy based on ISO 10360-8. (***) Valid for single measurements, height step measurements.

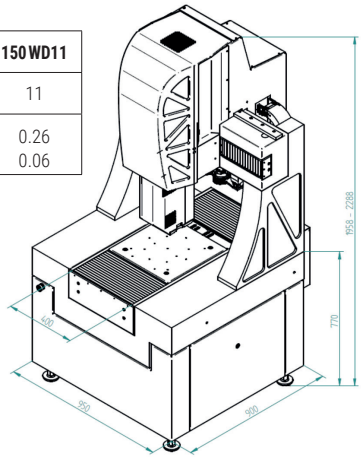
## OBJECTIVE SPECIFIC FEATURES

| **Objective** | | **3000 WD8** | **1900 WD30** | **1500 WD23** | **1500 WD70** | **800 WD17** | **800 WD37** | **400 WD19** | **150 WD11** |
|---|---|---|---|---|---|---|---|---|---|
| **Working distance*** | mm | 8.8 | 30 | 23.5 | 69.4 | 17.5 | 37 | 19 | 11 |
| **Lateral measurement range (X, Y)**<br>**(X x Y)** | mm<br>mm² | 5.26<br>27.64 | 3.29<br>10.8 | 2.63<br>6.91 | 2.63<br>6.91 | 1.32<br>1.71 | 1.32<br>1.71 | 0.66<br>0.43 | 0.26<br>0.06 |

***Objectives with longer working distance (up to 130mm) available on request.**

Initiative Fair Data Sheet

Specifications in blue mark Alicona specific values.




Isometric view - µCMM


# Optical dimensional metrology

## and surface roughness measurement

We are a global provider of optical, industrial measurement technology for quality assurance of complex components of different shapes, sizes and materials. Our non-contact measuring systems are used in all areas of precision manufacturing. Our core competence is the measurement of dimension, position, shape and roughness in the fields of production measurement technology and automation, prototype development as well as traditional quality assurance. Based on the technology of Focus-Variation, our measuring systems close the gap between classical dimensional metrology and surface roughness measurement, since users can measure both GD&T features and roughness parameters robustly, accurately, traceably and in high repeatability by using only one optical sensor.

Alicona has been part of Bruker since 2019 and now operates globally under the Bruker Alicona brand. Headquartered in Austria (Graz), measuring systems are developed, produced and distributed worldwide. An international sales, service and support team as well as selected distributors ensure regional customer proximity.

BRUKER

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